Halosaurus rostratus.

B. 9. D. 10. V. 9–10. L. transv. 13/6.

The length of the head exceeds much the height of the body. The snout very much produced, spatulate, its præoral portion being more than one half its length. Eye of moderate size, its length being one third of the postocular portion of the head, and considerably less than the width of the interorbital space. Maxillary scarcely reaching the front margin of the eye. The length of the head equals its distance from the root of the ventral, which is nearly entirely situated before the dorsal. Nearly all the scales are lost: but some of the lateral line remain; they are much larger than the other scales; and on the tail, where the lateral line approaches the lower profile, these larger scales fill up all the space between the lateral line and the anal fin.

Mid Atlantic, 2750 fathoms.

Nemichthys infans.

Body much less elongate and eye much smaller than in *N. scolopacea*. Vent twice as distant from the root of the pectorals as is the latter from the eye.

Mid Atlantic, 2500 fathoms.

Cyema, g. n. Muræni d.

This genus is the type of a new group of Muræni dæ allied to the *Nemichthyina*. It combines the form of the snout of a *Nemichthys* with the soft short body of a *Leptocephalus*; but the gill-openings are very narrow and close together on the abdominal surface. Vent in about the middle of the length of the body; vertical fin well developed, confined to and surrounding the tail. Pectoral fins well developed. Eye very small.

Cyema atrum.

The cleft of the mouth extends backwards to the end of the head. Black.

Pacific and Antarctic, 1500 and 1800 fathoms.

XXIX.—*On the Mode of Development of the Tentacles in the Genus* Hydra. By M. C. Mereschkowsky.

[Plate XII.]

In my article on the new Hydroid *Monobrachium parasitum**

* Ann. & Mag. Nat. Hist. ser. 4. vol. xx. p. 220.

I expressed the opinion that the fundamental number in the Hydroids (that is to say, the number which enters into the composition of all the other numbers) was not 4, but 2. I arrived at this opinion not only because numbers such as 6, 10, 14, 22, &c., which are not formed by the number 4, are to be met with often enough among the Hydroida, but also because many facts which I had come across in literature or observed myself have shown me that the appearance and sometimes the disappearance of organs in the Hydroida takes place in such a manner that they appear or disappear simultaneously two at a time.

Thus in the Medusæ belonging to *Monobrachium parasitum* I observed in a very young stage only four germinative sacs, which afterwards increased to eight sacs. The division of the four sacs into eight takes place by the simultaneous division, first, of only two sacs opposite one another, subsequently the other two sacs alone also beginning to divide longitudinally*.

In the following note it is my intention to give a description of my observations on the mode of production of the tentacles in *Hydra vulgaris* and *H. oligactis*. These observations were made in the spring of 1877 and 1878, and will serve to confirm my opinion as to the fundamental number in the Hydroida, and to establish a general law which governs the formation and the order of appearance of every organ in this class.

In the ponds of the neighbourhood of St. Petersburg *Hydra vulgaris* is met with very frequently during the whole of the summer season, and more rarely *Hydra oligactis*—distinguished from the former by the form of the body, which is distinctly divided into a cylindrical body and a peduncle of much greater tenuity.

In the month of May of the year 1877 I observed an example of the former species more than a centimetre in length in its normal uncontracted state, and furnished with seven long tentacles. Nearly in the middle of the body, but a little towards the base, this individual bore a whole colony of small *Hydræ*, buds in different stages of development, from individuals almost completely developed to others which were only in the form of short protuberances or monticules. I have represented the individual in question in Pl. XII. fig. 1. There will be seen first a small protuberance (I.) of a cylindrical and slightly conical form, entirely destitute of all traces of tentacles. The next stage here seen is represented by the bud (II.), which is a little larger and shows slight traces of tentacles, but still only as two slight elevations (*a* and *b*) of the superior

* *Loc. cit.* p. 223, pl. vi. figs. 12–14.

margin of the bud; and what is especially remarkable is that these two elevations or protuberances are placed opposite one another. I have frequently observed the first appearance of the tentacles in specimens quite recently fished out of the ponds, as also in artificial cultures in watch-glasses, following the process in one and the same individual; and the business has always been effected in the same manner. Observations made in June 1878 upon a specimen of *Hydra oligactis* found in the same locality as the preceding species proved the same thing. I may therefore say with certainty:—1, that at the commencement only two tentacles appear at once; and, 2, that these two tentacles are placed opposite each other *.

The next stage is that represented in Pl. XII. fig. 1, III. It will be observed that the first two tentacles (*a* and *b*) have become considerably elongated, and are equal in length to the body of the nursing-individual. Moreover there will be observed between the two tentacles and on one side only a very small protuberance (*c*), which represents the first indication of a third tentacle. In other specimens I have observed intermediate stages, in which the first two tentacles (*a* and *b*) had already attained a considerable length, while the third (*c*) had not yet appeared even in the form of a tubercle (Pl. XII. fig. 2). This curious creature then reminds us most strikingly of a form described by Dr. T. Strethill Wright† under the name of *Atractylis bitentaculata*, which he believed to be a mature organism. After what I have observed in *Hydra* I have no longer any doubt that we have in this Hydroid a similar case to that which is represented in fig. 2; that is to say, that *Atractylis bitentaculata* is not an independent form, but only a young stage of development of some other Hydroid. This is likewise the case with *Atractylis quadritentaculata* of the same author‡, which is also an embryonic form, although more advanced than the former.

The stage following that with three tentacles (III.) is the one represented in Pl. XII. fig. 3. This shows a young indivi-

* The first appearance of a tentacle does not differ in any way, except in size, from a very young bud still destitute of tentacles. Again, the first indications of a medusa are equally undistinguishable from a very young individual or from a very young tentacle. This is why I have already (Ann. & Mag. Nat. Hist., March 1878, pp. 250, 251) expressed the opinion that a tentacle is just as much an individual as the body of the hydranth or the manubrium of a medusa, but that, in consequence of the division of labour, the tentacle individual has been specially appropriated to the procurement of food and to defence, whilst the body itself is specially devoted to digestion. In short the hydranth is a colony.

† Journ. Anat. & Phys. i. p. 334, pl. xiv. fig. 5; and also Hincks, Brit. Hydr. p. 98.

‡ *Loc. cit.* fig. 6.

dual of *Hydra vulgaris* with four tentacles. It will be seen that the tentacle *c* is a little longer than the tentacle *d*, which is explained by the fact that *c* appeared earlier than *d*, and consequently has had a longer time to grow. This difference can only be easily observed at first; later on, when the four tentacles have grown (fig. 1, IV.), one can scarcely distinguish the tentacle *c* from *d*. But even much later one can still easily distinguish the first pair of tentacles from the second pair, which are shorter. It is true that generally each tentacle contracts independently of the other, so that it may happen that the tentacle *a* is more strongly contracted than *c*, and thus may even be the shorter of the two; but in this case it is easy to recognize the nature of the tentacle by its greater thickness. The individual IV. of fig. 1 had two long tentacles (*a* and *b*), which measured in the uncontracted state 1·25 millim.; the other two were scarcely more than half this length, one being 0·65 and the other 0·68 millim. long.

I have observed the mode of appearance of the tentacles many times in the two species; and I have no longer any doubt, 1, that they do not appear together, but one immediately after the other, and, 2, that they are arranged opposite each other and in the middle of the spaces between the first pair*. All these conclusions are not merely the results of the observation of different forms which I have had before me, but I have been able to follow them uninterruptedly upon the same individual.

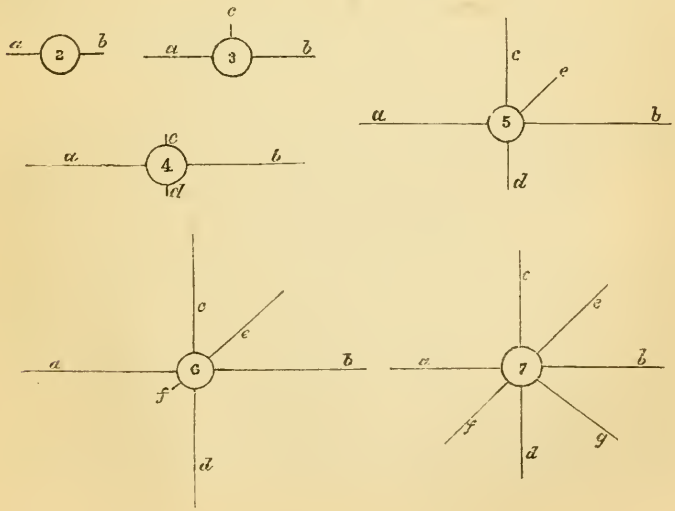
The fifth tentacle (Pl. XII. fig. 4, *e*) appears, like the third, in the form of a tubercle placed between two other tentacles, and not followed by the sixth—which does not make its appearance for some time, and, like all the others, appears on the side opposite and exactly facing the fifth. But what is especially remarkable is, that the appearance of the sixth tentacle is delayed much longer than that of the fourth (*d*) after the third. We have seen, in fact, that the fourth tentacle (*d*) appeared when the third (*c*) was still only a short cylindrical protuberance. The fifth tentacle (*e*), on the contrary, has time to become tolerably long and filiform before the sixth (*f*) makes its appearance. From all this it follows:—1, that the appearance of the sixth tentacle is much longer delayed than that of the fourth; and, 2, that the third pair is composed of two opposite tentacles, like the first two pairs.

This curious mode of appearance of the tentacles in the genus *Hydra* is, so far as I know, peculiar to it, and does not occur elsewhere among the Hydroida, in which we observe

* The two pairs being arranged so as to form a cross.

three types of development, viz. :—1, appearance in pairs; 2, appearance by four at a time; and, 3, appearance of all the tentacles at once, as, for example, in *Tubularia*. This exceptional case would serve very well to explain the fact (which is also exceptional) that in *Hydra* we very often observe the number 7, which does not accord with the formula $2 \times n$, that in general characterizes all the Cœlenterata. In fact, if the sixth tentacle does not appear until long after the fifth, we may expect that in the following (fourth) pair of tentacles the seventh will appear earlier than the eighth, and that this last will be delayed much more than even the sixth. It is in this way that we find a variable number of tentacles in the different species of *Hydra*, sometimes six, sometimes seven, sometimes eight, or even more. It may well be supposed that the individual sometimes dies before having had time to acquire an eighth tentacle, and that then, having only seven, its formula would be $(2 \times n) - 1$ or $(2 \times 4) - 1$; but from what we have seen I do not see why we should think that the number of tentacles in *Hydra* is subject to such variations that it cannot be governed by any law. On the contrary, we see that chance has nothing to do with it, that a very vigorous and constant law governs the appearance of the tentacles, and that the mode of appearance belongs to the first type that we have just established (appearance by pairs), although here it may be more or less modified.

From the diagrams below we may easily see the mode of appearance of the tentacles.



Thus the appearance of the tentacles in *Hydra* occurs in the following order:—The first two tentacles appear at the same time and are arranged opposite to each other; the other tentacles also appear in pairs, and are also arranged opposite one another: but the second tentacle of each pair always appears later than the first; and this retardation is greater in the third pair than in the second, and still greater in the fourth pair.

Taking into consideration all that has been said, I hope it will be seen that the genus *Hydra*, and especially *Hydra oligactis*, is derived from the type which is represented by the formula 2×4, as I have indicated it in the genealogical table given in my article on *Monobrachium* *.

A bud does not require a very long time for its development. The first tubercle of the individual increases in size very considerably in half an hour, and already develops two little tentacles. In about 20 hours this bud had four well-developed tentacles; and in 20 hours more there were already five tentacles.

In all this we may easily see that the facts are subjected to a general law, although, owing to the great complexity of the facts, the law does not strike one at once, and can only be ascertained by carefully studying the genesis of the animals. As a general conclusion we may admit that in *Hydra each pair of opposite tentacles forms a system*, and that these two tentacles are singularly connected in such a manner that the appearance of one tentacle is followed by that of another opposite to it. In this we observe a sort of polarity between the two metameres—a fact the frequent occurrence of which among the Hydroids I hope to prove some other time.

EXPLANATION OF PLATE XII.

Fig. 1. *Hydra vulgaris.* An adult individual with seven tentacles in a fully extended state; a little below the middle of the body it bears four buds or young individuals, namely:—I., a bud without tentacles; II., a larger bud, furnished with two tentacles (*a* and *b*) in the form of tubercles, which have appeared simultaneously and are arranged opposite one another; III., a still more advanced bud, the tentacles *a* and *b* being considerably enlarged, and the third tentacle (*c*) only presenting the form of a tubercle, without yet having the fourth tentacle opposite to it; IV., a young individual with four tentacles, two longer (*a* and *b*) and two others shorter, also arranged opposite each other (*c* and *d*), the four tentacles arranged so as to form a cross. The tentacle *c*, which appeared earlier (see III.), is a little longer than *d*.

Fig. 2. A young individual of the same species, representing the same stage as fig. 1, II., but in a more advanced state. First pair of

* Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 227.

tentacles (*a* and *b*) greatly developed, but not the smallest trace of a third tentacle, thus resembling *Atractylis bitentaculata*, Wright.

Fig. 3. A young individual of the same species in an earlier stage than that represented in fig. 1, iv. The fourth tentacle (*d*) has just appeared, while the third, opposite to it, is already tolerably long: *a* and *b* are the first pair of tentacles.

Fig. 4. *Hydra oligactis.* A young individual still attached to the parent and already furnished with five tentacles: *a* and *b* first pair; *c* and *d* second pair; *e*, fifth tentacle, the first of the third pair; the sixth is on the point of making its appearance.

XXX.—*Descriptions of new Species of Rhopalocera from Central and South America.* By F. Du Cane Godman and Osbert Salvin.

Nymphalidæ.

Danainæ.

1. *Callithomia panamensis.*

♂. Exp. 2·7 in. Above—basal third of primaries and basal half of secondaries rufous; marginal half of secondaries and apical third of primaries brownish black; an irregular band, crossing the primaries from the costa to the anal angle, and four spots near the apex yellow; a black spot in the middle of the cell, and another at the end confluent with the dark apex. Beneath with six submarginal white spots on the secondaries and two at apex of the primaries. Distal half of the antennæ yellow.

Hab. Panama, Candelaria (*Ribbe*).

Mus. Dr. O. Staudinger.

Obs. In coloration this species almost exactly resembles *Ceratinia megalopolis*, Feld.; the neuration, however, is that of *Callithomia*. It also much resembles *Ithomia beronilla*, Hew., a species which possibly also belongs to the genus *Callithomia*.

2. *Napeogenes pædaretus.*

♂. Exp. 2·65 in. Yellowish diaphanous; margins of both wings, and a triangular spot at the end of the cell, and the radial and median branches of the primaries black; median nervure of the primaries and space below it, the inner edge of the dark margin, also the median nervure of the secondaries and its branches fulvous; apex of the primaries clouded, except elongated yellowish diaphanous submarginal spots between the nervules. Beneath as above, with a row of seven white spots in the dark margin of the primaries, and the same num-